

Appendix B: Example Items

After each administration of TIMSS, the IEA releases to the public somewhat less than half of the TIMSS items in order to illustrate the content of the assessment. The remaining items are kept secure so they can be used again in a future administration of TIMSS to measure trends in performance. This appendix contains sample mathematics and science items used in the U.S. administration of TIMSS 2011. These items have been selected from the set of released items to provide examples from each of the international benchmark levels, each of the content and cognitive domains, and each of the response types.

Exhibits B.1 and B.2 below provide a key to which items are examples of each of these dimensions, B.1 for mathematics and B.2 for science. Reading exhibit B.1, for example, one can see that two items illustrate the Number content domain at grade 4 (exhibits B.5 and B.6) but that each of these represents a different benchmark level, a different cognitive domain, and a different item response type. Each item is presented on a separate page in this appendix. For all multiple choice items, the test question and “response options” (possible answers) are reproduced on the page along with the “item key” (correct answer). For all constructed-response items, the “scoring rubric” (the criteria for scoring) is reproduced along with the test question. All item pages also include the percentage of students who received full credit for their answer in each participating country or other education system. Note that although most constructed response items were worth 1 point, some were worth 2 points with 1 point awarded for partial credit. In this appendix, if an example item was worth 2 points, only the percentages of students with responses awarded 2 points (full credit) are shown.

Exhibit B-1. Sample TIMSS 2011 mathematics items, by grade level, international benchmark level, content domain, cognitive domain, and item response type

Exhibit number, by grade	International benchmark level	Content domain	Cognitive domain	Item response type
Grade 4				
B.3	Low	Data Display	Applying	CR
B.4	Intermediate	Geometric Shapes and Measures	Knowing	MC
B.5	High	Number	Reasoning	MC
B.6	Advanced	Number	Applying	CR
Grade 8				
B.7	Low	Number	Knowing	CR
B.8	Intermediate	Algebra	Knowing	CR
B.9	High	Data and Chance	Reasoning	MC
B.10	Advanced	Geometry	Applying	MC

NOTE: CR indicates constructed-response item. MC indicates multiple choice item.

Exhibit B-2. Sample TIMSS 2011 science items, by grade level, international benchmark level, content domain, cognitive domain, and item response type

Exhibit number, by grade	International benchmark level	Content domain	Cognitive domain	Item response type
Grade 4				
B.11	Low	Life Science	Applying	MC
B.12	Intermediate	Physical Science	Knowing	MC
B.13	High	Life Science	Reasoning	CR
B.14	Advanced	Earth Science	Applying	CR
Grade 8				
B.15	Low	Chemistry	Applying	MC
B.16	Intermediate	Biology	Knowing	MC
B.17	High	Earth Science	Knowing	CR
B.18	Advanced	Physics	Reasoning	CR

NOTE: CR indicates constructed-response item. MC indicates multiple choice item.

Exhibit B-3. Example 4th-grade mathematics item: 2011

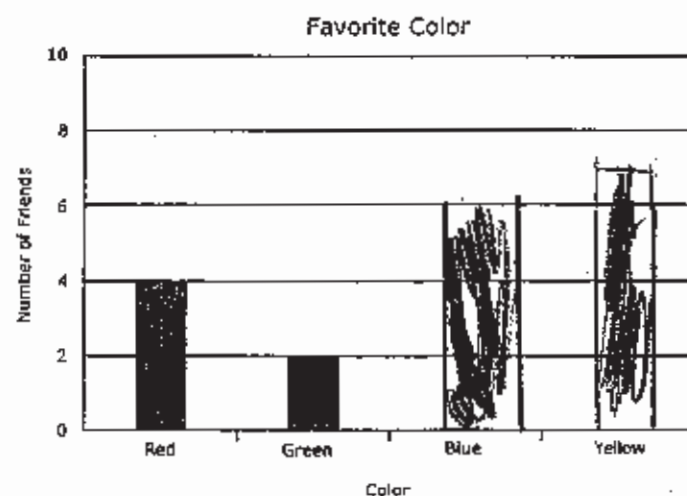
International Benchmark Level	Low
Content Domain	Data Display
Cognitive Domain	Applying

Favorite colors of Darin's friends

Darin asked his friends to name their favorite color. He collected the information in the table shown below.

Favorite Color	Number of Friends
Red	4
Green	2
Blue	6
Yellow	7

Then Darin started to draw a graph to show the information. Complete Darin's graph.



¹National Defined Population covers 90 to 95 percent of National Target Population (see appendix A).

²Met guidelines for sample participation rates only after replacement schools were included.

³National Target Population does not include all of the International Target Population (see appendix A).

⁴Nearly satisfied guidelines for sample participation rates after replacement schools were included.

⁵The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 15 percent, though it is less than 25 percent.

⁶Exclusion rates for Azerbaijan and Georgia are slightly underestimated as some conflict zones were not covered and no official statistics were available.

⁷The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 25 percent.

⁸National Defined Population covers less than 90 percent, but at least 77 percent, of National Target Population (see appendix A).

NOTE: Education systems are sorted by 2011 average percent correct. The answer shown illustrates the type of student response that was given full credit.

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

Education system	Percent full credit
International average	73
Korea, Rep. of	97
Singapore ¹	95
Hong Kong-CHN ¹	95
Japan	93
Northern Ireland-GBR ²	92
Netherlands ²	91
England-GBR	89
Finland	88
Germany	88
Lithuania ^{1,3}	87
Ireland	87
Chinese Taipei-CHN	87
Belgium (Flemish)-BEL	86
Australia	84
Portugal	84
Denmark ¹	84
Sweden	83
Malta	83
Hungary	83
Russian Federation	81
New Zealand	81
Austria	80
Slovenia	80
Thailand	78
United States ¹	78
Spain	78
Slovak Republic	77
Czech Republic	77
Italy	77
Bahrain	75
Croatia ¹	74
Norway ⁴	74
Turkey	73
Kazakhstan ¹	73
Poland	73
Qatar ¹	70
Chile	69
United Arab Emirates	68
Serbia ¹	67
Romania	62
Saudi Arabia	60
Oman ⁵	57
Georgia ^{3,6}	56
Kuwait ^{3,7}	55
Iran, Islamic Rep. of	54
Azerbaijan ^{1,6}	47
Armenia	41
Tunisia ⁵	24
Morocco ⁷	23
Yemen ⁷	13

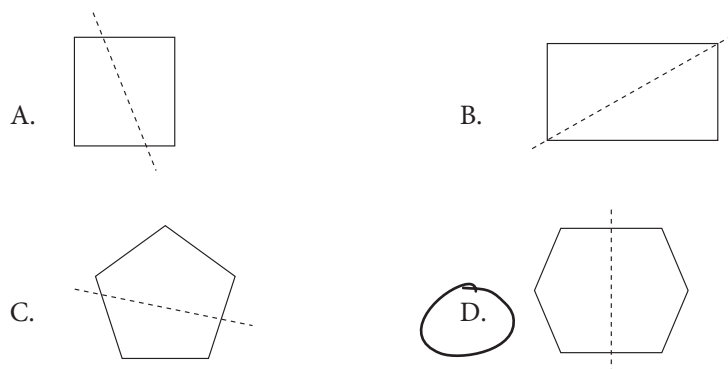
Benchmarking education systems	Percent full credit
Quebec-CAN	89
Ontario-CAN	87
North Carolina-USA ^{1,3}	82
Alberta-CAN ¹	81
Florida-USA ^{3,8}	80
Dubai-UAE	75
Abu Dhabi-UAE	62

Exhibit B-4. Example 4th-grade mathematics item: 2011

International Benchmark Level	Intermediate
Content Domain	Geometric Shapes and Measures
Cognitive Domain	Knowing

Which dotted line is a line of symmetry?

In which of the following figures is the dotted line a line of symmetry?



¹National Defined Population covers 90 to 95 percent of National Target Population (see appendix A).

²Met guidelines for sample participation rates only after replacement schools were included.

³National Target Population does not include all of the International Target Population (see appendix A).

⁴The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 25 percent.

⁵The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 15 percent, though it is less than 25 percent.

⁶Nearly satisfied guidelines for sample participation rates after replacement schools were included.

⁷Exclusion rates for Azerbaijan and Georgia are slightly underestimated as some conflict zones were not covered and no official statistics were available.

⁸National Defined Population covers less than 90 percent, but at least 77 percent, of National Target Population (see appendix A).

NOTE: Education systems are sorted by 2011 average percent correct. The answer shown illustrates the type of student response that was given full credit.

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

Education system	Percent full credit
International average	54
Singapore ¹	91
Hong Kong-CHN ¹	81
United States¹	80
Australia	76
Korea, Rep. of	75
Northern Ireland-GBR ²	74
England-GBR	71
Malta	70
Ireland	66
Turkey	65
Denmark ¹	65
Saudi Arabia	65
Germany	64
Iran, Islamic Rep. of	64
Portugal	63
Italy	63
Czech Republic	63
Hungary	61
Lithuania ^{1,3}	61
Kazakhstan ¹	59
Russian Federation	58
Kuwait ^{3,4}	58
Bahrain	57
Oman ⁵	54
United Arab Emirates	54
Chile	53
New Zealand	53
Thailand	53
Norway ⁶	52
Azerbaijan ^{1,7}	52
Romania	50
Qatar ¹	50
Slovenia	49
Austria	49
Belgium (Flemish)-BEL	49
Finland	49
Spain	48
Georgia ^{3,7}	44
Serbia ¹	43
Chinese Taipei-CHN	43
Poland	40
Slovak Republic	40
Armenia	39
Morocco ⁴	37
Sweden	32
Netherlands ²	30
Croatia ¹	30
Japan	30
Yemen ⁴	27
Tunisia ⁵	22

Benchmarking education systems	Percent full credit
Florida-USA ^{3,8}	87
North Carolina-USA ^{1,3}	86
Ontario-CAN	76
Alberta-CAN ¹	62
Quebec-CAN	62
Abu Dhabi-UAE	54
Dubai-UAE	52

Exhibit B-5. Example 4th-grade mathematics item: 2011

International Benchmark Level	High
Content Domain	Number
Cognitive Domain	Reasoning

Distance between towns using map

The scale on a map indicates that 1 centimeter on the map represents 4 kilometers on the land. The distance between the two towns on the map is 8 centimeters. How many kilometers apart are the two towns?

- A. 2
B. 8
C. 16
D. 32

Education system	Percent full credit
International average	54
Korea, Rep. of	84
<i>Chinese Taipei-CHN</i>	84
Russian Federation	80
Lithuania ^{1,2}	75
Japan	74
Finland	71
Serbia ²	71
Singapore ²	69
Netherlands ³	69
Kazakhstan ²	69
Czech Republic	67
Azerbaijan ^{2,4}	66
Croatia ²	64
Denmark ²	63
Slovenia	63
<i>Northern Ireland-GBR³</i>	62
Slovak Republic	61
Germany	60
Hungary	59
United States²	59
Portugal	57
Romania	57
Sweden	57
Austria	57
Poland	57
Norway ⁵	56
Iran, Islamic Rep. of	55
<i>England-GBR</i>	54
Italy	54
<i>Belgium (Flemish)-BEL</i>	53
Ireland	50
Turkey	48
Georgia ^{1,4}	47
Australia	46
Spain	46
Armenia	45
New Zealand	42
Bahrain	40
Chile	39
Thailand	39
Saudi Arabia	39
United Arab Emirates	37
Qatar ²	32
Malta	32
Morocco ⁶	31
Oman ⁷	31
Tunisia ⁷	31
Yemen ⁶	29
Kuwait ^{1,6}	23
<i>Hong Kong-CHN²</i>	—

Benchmarking education systems	Percent full credit
<i>North Carolina-USA^{1,2}</i>	62
<i>Florida-USA^{1,8}</i>	62
<i>Quebec-CAN</i>	57
<i>Ontario-CAN</i>	50
<i>Alberta-CAN²</i>	43
<i>Dubai-UAE</i>	42
<i>Abu Dhabi-UAE</i>	33

— Not available.

¹National Target Population does not include all of the International Target Population (see appendix A).

²National Defined Population covers 90 to 95 percent of National Target Population (see appendix A).

³Met guidelines for sample participation rates only after replacement schools were included.

⁴Exclusion rates for Azerbaijan and Georgia are slightly underestimated as some conflict zones were not covered and no official statistics were available.

⁵Nearly satisfied guidelines for sample participation rates after replacement schools were included.

⁶The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 25 percent.

⁷The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 15 percent, though it is less than 25 percent.

⁸National Defined Population covers less than 90 percent, but at least 77 percent, of National Target Population (see appendix A).

NOTE: Education systems are sorted by 2011 average percent correct. The answer shown illustrates the type of student response that was given full credit.

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

Exhibit B-6. Example 4th-grade mathematics item: 2011

International Benchmark Level	Advanced
Content Domain	Number
Cognitive Domain	Applying

Recipe for 3 people

Ingredients	
Eggs	4
Flour	8 cups
Milk	$\frac{1}{2}$ cup

The above ingredients are used to make a recipe for 6 people. Sam wants to make this recipe for only 3 people.

Complete the table below to show what Sam needs to make the recipe for 3 people. The number of eggs he needs is shown.

Ingredients	
Eggs	2
Flour	<u>4</u> cups
Milk	$\frac{1}{4}$ cup

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¹Met guidelines for sample participation rates only after replacement schools were included.

²National Defined Population covers 90 to 95 percent of National Target Population (see appendix A).

³National Target Population does not include all of the International Target Population (see appendix A).

⁴Exclusion rates for Azerbaijan and Georgia are slightly underestimated as some conflict zones were not covered and no official statistics were available.

⁵Nearly satisfied guidelines for sample participation rates after replacement schools were included.

⁶The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 15 percent, though it is less than 25 percent.

⁷The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 25 percent.

⁸National Defined Population covers less than 90 percent, but at least 77 percent, of National Target Population (see appendix A).

NOTE: Education systems are sorted by 2011 average percent correct. The answer shown illustrates the type of student response that was given full credit.

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

Education system	Percent full credit
International Avg.	23
Northern Ireland-GBR ¹	63
England-GBR	55
Ireland	54
Singapore ²	50
Germany	46
Netherlands ¹	41
New Zealand	39
Belgium (Flemish)-BEL	38
Denmark ²	37
Australia	37
Hong Kong-CHN ²	34
United States ²	33
Malta	31
Finland	31
Chinese Taipei-CHN	31
Portugal	28
Korea, Rep. of	28
Serbia ²	27
Lithuania ^{2,3}	24
Japan	23
Austria	23
Kazakhstan ²	22
Spain	22
Romania	22
Qatar ²	21
Bahrain	20
Azerbaijan ^{2,4}	20
Russian Federation	20
United Arab Emirates	20
Hungary	18
Saudi Arabia	18
Slovenia	17
Poland	16
Norway ⁵	15
Sweden	15
Armenia	15
Chile	15
Italy	14
Georgia ^{3,4}	13
Oman ⁶	11
Czech Republic	10
Slovak Republic	10
Kuwait ^{3,7}	8
Turkey	8
Thailand	5
Tunisia ⁶	5
Morocco ⁷	4
Croatia ²	3
Yemen ⁷	3
Iran, Islamic Rep. of	3

Benchmarking education systems	Percent full credit
North Carolina-USA ^{2,3}	32
Florida-USA ^{3,8}	31
Dubai-UAE	29
Quebec-CAN	22
Alberta-CAN ²	22
Ontario-CAN	22
Abu Dhabi-UAE	15

Exhibit B-7. Example 8th-grade mathematics item: 2011

International Benchmark Level	Low
Content Domain	Number
Cognitive Domain	Knowing

Add 42.65 to 5.748

$$42.65 + 5.748 =$$

Answer: 48.398

Education system	Percent full credit
International Avg.	72
Singapore ¹	94
Malaysia	91
<i>Hong Kong-CHN</i>	91
Kazakhstan	90
Lithuania ¹	90
Russian Federation ¹	90
<i>Chinese Taipei-CHN</i>	89
United States¹	89
Hungary	88
Italy	88
Korea, Rep. of	87
Slovenia	85
Armenia	84
Tunisia	82
Israel ²	82
Australia	82
Norway	81
Lebanon	81
Japan	81
Ukraine	80
United Arab Emirates	79
Sweden	79
<i>England-GBR³</i>	79
Finland	79
Morocco ⁴	72
Qatar ⁵	72
New Zealand	70
Romania	69
Saudi Arabia ⁵	65
Macedonia, Rep. of ⁵	65
Georgia ^{6,7}	64
Thailand	64
Chile	58
Indonesia ⁵	57
Palestinian Nat'l Auth. ⁵	56
Oman ⁵	49
Turkey	48
Bahrain ⁵	43
Iran, Islamic Rep. of ⁵	42
Jordan ⁵	36
Ghana ⁴	36
Syrian Arab Republic ⁵	31

Benchmarking education systems	Percent full credit
<i>Massachusetts-USA^{1,6}</i>	95
<i>Minnesota-USA⁶</i>	93
<i>Florida-USA^{1,6}</i>	93
<i>Alabama-USA⁶</i>	92
<i>Connecticut-USA^{1,6}</i>	91
<i>Indiana-USA^{1,6}</i>	90
<i>North Carolina-USA^{2,6}</i>	90
<i>Quebec-CAN</i>	90
<i>California-USA^{1,6}</i>	89
<i>Alberta-CAN¹</i>	86
<i>Ontario-CAN¹</i>	85
<i>Colorado-USA⁶</i>	82
<i>Abu Dhabi-UAE</i>	81
<i>Dubai-UAE</i>	80

¹National Defined Population covers 90 to 95 percent of National Target Population (see appendix A).

²National Defined Population covers less than 90 percent, but at least 77 percent, of National Target Population (see appendix A).

³Nearly satisfied guidelines for sample participation rates after replacement schools were included.

⁴The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 25 percent.

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⁶National Target Population does not include all of the International Target Population (see appendix A).

⁷Exclusion rates for Georgia are slightly underestimated as some conflict zones were not covered and no official statistics were available.

NOTE: Education systems are sorted by 2011 average percent correct. The answer shown illustrates the type of student response that was given full credit.

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

Exhibit B-8. Example 8th-grade mathematics item: 2011

International Benchmark Level	Intermediate
Content Domain	Algebra
Cognitive Domain	Knowing

Next term in the pattern

$$\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \frac{5}{6}$$

A. What is the next term in this pattern?

Answer: $\frac{6}{7}$

M042198A

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NOTE: Education systems are sorted by 2011 average percent correct. The answer shown illustrates the type of student response that was given full credit.

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

Education system	Percent full credit
International Avg.	70
Japan	94
Singapore ¹	94
Korea, Rep. of	92
Hong Kong-CHN	92
Chinese Taipei-CHN	92
Finland	91
Australia	91
Slovenia	90
Hungary	90
New Zealand	89
England-GBR ²	89
Sweden	88
Norway	88
United States ¹	87
Lithuania ³	86
Israel ⁴	85
Italy	85
Ukraine	85
Russian Federation ¹	82
Romania	81
Kazakhstan	78
Turkey	77
Tunisia	76
United Arab Emirates	70
Iran, Islamic Rep. of ⁵	68
Thailand	68
Armenia	66
Macedonia, Rep. of ⁵	66
Bahrain ⁵	62
Qatar ⁵	56
Georgia ^{3,6}	53
Malaysia	53
Jordan ⁵	45
Syrian Arab Republic ⁵	44
Lebanon	43
Ghana ⁷	38
Oman ⁵	37
Palestinian Nat'l Auth. ⁵	36
Saudi Arabia ⁵	33
Indonesia ⁵	32
Chile	32
Morocco ⁷	15

Benchmarking education systems	Percent full credit
Massachusetts-USA ^{1,3}	94
Quebec-CAN	92
Ontario-CAN ¹	92
Indiana-USA ^{1,3}	91
Alberta-CAN ¹	90
Colorado-USA ³	90
Minnesota-USA ³	90
North Carolina-USA ^{3,4}	89
Connecticut-USA ^{1,3}	88
Florida-USA ^{1,3}	87
Alabama-USA ³	87
California-USA ^{1,3}	86
Dubai-UAE	79
Abu Dhabi-UAE	68

Exhibit B-9. Example 8th-grade mathematics item: 2011

International Benchmark Level	High
Content Domain	Data and Chance
Cognitive Domain	Reasoning

Probability that the marble is red

There are 10 marbles in a bag: 5 red, and 5 blue.

Sue draws a marble from the bag at random. The marble is red.

She puts the marble back into the bag.

What is the probability that the next marble she draws at random is red?

- A. $\frac{1}{2}$
- B. $\frac{4}{10}$
- C. $\frac{1}{5}$
- D. $\frac{1}{10}$

Education system	Percent full credit
International Avg.	45
Singapore ¹	78
Korea, Rep. of	76
Australia	75
England-GBR ²	72
Japan	70
Chinese Taipei-CHN	70
New Zealand	68
Slovenia	67
United States ¹	66
Finland	66
Sweden	65
Norway	64
Hong Kong-CHN	64
Israel ³	59
Hungary	51
Lithuania ⁴	51
Russian Federation ¹	47
Turkey	44
Italy	42
Macedonia, Rep. of ⁵	41
Romania	39
Armenia	39
Palestinian Nat'l Auth. ⁵	38
Ukraine	38
Kazakhstan	38
Thailand	37
United Arab Emirates	36
Indonesia ⁵	35
Iran, Islamic Rep. of ⁵	35
Saudi Arabia ⁵	35
Qatar ⁵	34
Georgia ^{4,6}	33
Chile	31
Ghana ⁷	28
Malaysia	28
Jordan ⁵	26
Bahrain ⁵	24
Oman ⁵	23
Lebanon	21
Tunisia	20
Syrian Arab Republic ⁵	18
Morocco ⁷	16

Benchmarking education systems	Percent full credit
Massachusetts-USA ^{1,4}	79
Minnesota-USA ⁴	78
Connecticut-USA ^{1,4}	78
Colorado-USA ⁴	76
Indiana-USA ^{1,4}	76
North Carolina-USA ^{3,4}	74
Alberta-CAN ¹	73
Ontario-CAN ¹	73
Quebec-CAN	72
Florida-USA ^{1,4}	60
California-USA ^{1,4}	60
Alabama-USA ⁴	52
Dubai-UAE	45
Abu Dhabi-UAE	34

¹National Defined Population covers 90 to 95 percent of National Target Population (see appendix A).

²Nearly satisfied guidelines for sample participation rates after replacement schools were included.

³National Defined Population covers less than 90 percent, but at least 77 percent, of National Target Population (see appendix A).

⁴National Target Population does not include all of the International Target Population (see appendix A).

⁵The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 15 percent, though it is less than 25 percent.

⁶Exclusion rates for Georgia are slightly underestimated as some conflict zones were not covered and no official statistics were available.

⁷The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 25 percent.

NOTE: Education systems are sorted by 2011 average percent correct. The answer shown illustrates the type of student response that was given full credit.

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

Exhibit B-10. Example 8th-grade mathematics item: 2011

International Benchmark Level	Advanced
Content Domain	Geometry
Cognitive Domain	Applying

Degrees minute hand of clock turns

How many degrees does a minute hand of a clock turn through from 6:20 a.m. to 8:00 a.m. on the same day?

- A. 680°
 B. 600°
 C. 540°
 D. 420°

M032331

— Not available.

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²Nearly satisfied guidelines for sample participation rates after replacement schools were included.

³The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 25 percent.

⁴The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 15 percent, though it is less than 25 percent.

⁵National Defined Population covers less than 90 percent, but at least 77 percent, of National Target Population (see appendix A).

⁶National Target Population does not include all of the International Target Population (see appendix A).

⁷Exclusion rates for Georgia are slightly underestimated as some conflict zones were not covered and no official statistics were available.

NOTE: Education systems are sorted by 2011 average percent correct. The answer shown illustrates the type of student response that was given full credit.

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

Education system	Percent full credit
International Avg.	29
Korea, Rep. of	63
Japan	58
Singapore ¹	57
Chinese Taipei-CHN	56
Hong Kong-CHN	51
Finland	32
Sweden	31
England-GBR ²	31
Slovenia	31
Morocco ³	30
Hungary	30
Syrian Arab Republic ⁴	30
Palestinian Nat'l Auth. ⁴	29
Russian Federation ¹	29
Saudi Arabia ⁴	28
Macedonia, Rep. of ⁴	28
Turkey	27
Israel ⁵	27
Australia	27
New Zealand	26
Iran, Islamic Rep. of ⁴	26
Tunisia	26
Malaysia	26
Ukraine	25
Armenia	25
Italy	25
Jordan ⁴	25
Lebanon	24
Bahrain ⁴	24
Romania	23
Norway	23
Kazakhstan	23
United Arab Emirates	23
United States ¹	22
Qatar ⁴	22
Oman ⁴	21
Lithuania ⁶	21
Ghana ³	21
Georgia ^{6,7}	19
Indonesia ⁴	19
Thailand	16
Chile	—

Benchmarking education systems	Percent full credit
Quebec-CAN	30
Minnesota-USA ⁶	29
Ontario-CAN ¹	26
North Carolina-USA ^{5,6}	26
Massachusetts-USA ^{1,6}	25
Dubai-UAE	24
Connecticut-USA ^{1,6}	24
Abu Dhabi-UAE	23
Indiana-USA ^{1,6}	19
Alberta-CAN ¹	19
Alabama-USA ⁶	18
Colorado-USA ⁶	18
Florida-USA ^{1,6}	18
California-USA ^{1,6}	17

Exhibit B-11. Example 4th-grade science item: 2011

International Benchmark Level	Low
Content Domain	Life Science
Cognitive Domain	Applying

Birds/bats/butterflies share

What do birds, bats and butterflies have in common?

- A. feathers
- B. hair
- C. internal skeleton
- ☒ D. wings

Education system	Percent full credit
International Avg.	83
Korea, Rep. of	99
United States¹	96
Croatia ¹	95
Singapore ¹	95
Finland	95
Sweden	95
Ireland	95
Austria	94
England-GBR	94
Norway ²	93
Germany	93
New Zealand	93
Portugal	92
Russian Federation	92
Australia	92
Slovenia	91
Netherlands ³	91
Northern Ireland-GBR ³	91
Denmark ¹	91
Serbia ¹	91
Czech Republic	90
Poland	90
Slovak Republic	89
Italy	89
Lithuania ^{1,4}	89
Belgium (Flemish)-BEL	88
Spain	87
Japan	87
Thailand	86
Georgia ^{4,5}	86
Hungary	84
Chile	84
Armenia	83
Chinese Taipei-CHN	83
Romania	83
Malta	82
Hong Kong-CHN ¹	79
Kazakhstan ¹	79
Turkey	79
Bahrain	75
Azerbaijan ^{1,5}	75
United Arab Emirates	74
Saudi Arabia	70
Iran, Islamic Rep. of	62
Qatar ¹	62
Tunisia ⁶	61
Oman	61
Kuwait ^{4,6}	54
Morocco ⁷	47
Yemen ⁷	31

Benchmarking education systems	Percent full credit
Florida-USA ^{4,8}	97
Alberta-CAN ¹	96
North Carolina-USA ^{1,4}	95
Ontario-CAN	93
Quebec-CAN	92
Dubai-UAE	79
Abu Dhabi-UAE	70

¹National Defined Population covers 90 to 95 percent of National Target Population (see appendix A).

²Nearly satisfied guidelines for sample participation rates after replacement schools were included.

³Met guidelines for sample participation rates only after replacement schools were included.

⁴National Target Population does not include all of the International Target Population (see appendix A).

⁵Exclusion rates for Azerbaijan and Georgia are slightly underestimated as some conflict zones were not covered and no official statistics were available.

⁶The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 15 percent, though it is less than 25 percent.

⁷The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 25 percent.

⁸National Defined Population covers less than 90 percent, but at least 77 percent, of National Target Population (see appendix A).

NOTE: Education systems are sorted by 2011 average percent correct. The answer shown illustrates the type of student response that was given full credit.

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

Exhibit B-12. Example 4th-grade science item: 2011

International Benchmark Level	Intermediate
Content Domain	Physical Science
Cognitive Domain	Knowing

Temperature of ice, steam, water

Water, ice, and steam all have different temperatures.

What is the order from coldest to hottest?

- ☒ A. ice, water, steam
- ☐ B. ice, steam, water
- ☐ C. steam, ice, water
- ☐ D. steam, water, ice

S051086

— Not available.

¹National Defined Population covers 90 to 95 percent of National Target Population (see appendix A).

²Met guidelines for sample participation rates only after replacement schools were included.

³Nearly satisfied guidelines for sample participation rates after replacement schools were included.

⁴National Target Population does not include all of the International Target Population (see appendix A).

⁵Exclusion rates for Azerbaijan and Georgia are slightly underestimated as some conflict zones were not covered and no official statistics were available.

⁶The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 15 percent, though it is less than 25 percent.

⁷The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 25 percent.

⁸National Defined Population covers less than 90 percent, but at least 77 percent, of National Target Population (see appendix A).

NOTE: Education systems are sorted by 2011 average percent correct. The answer shown illustrates the type of student response that was given full credit.

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

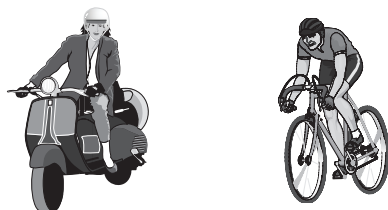
Education system	Percent full credit
International Avg.	73
United States¹	90
Netherlands ²	88
Singapore ¹	87
Croatia ¹	87
Czech Republic	86
Hong Kong-CHN ¹	86
Italy	84
Russian Federation	84
Serbia ¹	84
Belgium (Flemish)-BEL	84
Australia	83
Slovak Republic	83
Denmark ¹	83
Finland	82
Spain	81
Hungary	81
Slovenia	80
Chile	80
England-GBR	80
Chinese Taipei-CHN	80
Korea, Rep. of	80
Austria	79
Northern Ireland-GBR ²	79
Germany	79
Sweden	79
New Zealand	78
Ireland	76
Norway ³	75
Kazakhstan ¹	73
Japan	72
Turkey	71
Romania	71
Bahrain	71
Lithuania ^{1,4}	70
Malta	70
United Arab Emirates	69
Saudi Arabia	67
Azerbaijan ^{1,5}	65
Poland	63
Georgia ^{4,5}	62
Iran, Islamic Rep. of	61
Qatar ¹	61
Armenia	59
Oman	56
Kuwait ^{4,6}	55
Thailand	55
Tunisia ⁶	41
Morocco ⁷	37
Yemen ⁷	29
Portugal	—

Benchmarking education systems	Percent full credit
Florida-USA ^{4,8}	94
North Carolina-USA ^{1,4}	90
Alberta-CAN ¹	86
Ontario-CAN	85
Dubai-UAE	73
Quebec-CAN	72
Abu Dhabi-UAE	70

Exhibit B-13. Example 4th-grade science item: 2011

International Benchmark Level	High
Content Domain	Life Science
Cognitive Domain	Reasoning

Better way to travel around town



The pictures above show two ways of traveling around town.

A. Which way of traveling is better for the environment?

(Check one box.)

- ☒ Bicycle
☐ Motorbike

B. Explain your answer.

Because the motorcicle
 send oil up to the atmosphere
 and the ozone layer.

¹National Defined Population covers 90 to 95 percent of National Target Population (see appendix A).

²Met guidelines for sample participation rates only after replacement schools were included.

³National Target Population does not include all of the International Target Population (see appendix A).

⁴Nearly satisfied guidelines for sample participation rates after replacement schools were included.

⁵The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 15 percent, though it is less than 25 percent.

⁶Exclusion rates for Azerbaijan and Georgia are slightly underestimated as some conflict zones were not covered and no official statistics were available.

⁷The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 25 percent.

⁸National Defined Population covers less than 90 percent, but at least 77 percent, of National Target Population (see appendix A).

NOTE: Education systems are sorted by 2011 average percent correct. The answer shown illustrates the type of student response that was given full credit.

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

Education system	Percent full credit
International Avg.	48
Korea, Rep. of	83
Croatia ¹	78
Portugal	75
Slovenia	73
Finland	70
Italy	70
Sweden	68
Hungary	68
Russian Federation	67
Chinese Taipei-CHN	67
Spain	64
Czech Republic	64
Chile	63
Serbia ¹	62
Germany	62
Iran, Islamic Rep. of	61
Slovak Republic	60
Austria	60
Singapore ¹	54
Poland	54
Netherlands ²	53
Belgium (Flemish)-BEL	53
Romania	51
Lithuania ^{1,3}	50
Norway ⁴	49
England-GBR	47
Hong Kong-CHN ¹	45
Japan	45
Denmark ¹	44
United States ¹	43
Northern Ireland-GBR ²	43
New Zealand	42
Australia	42
Ireland	41
Kazakhstan ¹	40
Bahrain	39
Turkey	38
Thailand	36
Tunisia ⁵	35
United Arab Emirates	31
Malta	30
Qatar ¹	29
Armenia	29
Saudi Arabia	28
Georgia ^{3,6}	28
Morocco ⁷	24
Kuwait ^{3,5}	20
Oman	18
Azerbaijan ^{1,6}	12
Yemen ⁷	4

Benchmarking education systems	Percent full credit
Alberta-CAN ¹	54
Ontario-CAN	51
Florida-USA ^{3,8}	46
Quebec-CAN	45
Dubai-UAE	40
North Carolina-USA ^{1,3}	36
Abu Dhabi-UAE	31

Exhibit B-14. Example 4th-grade science item: 2011

International Benchmark Level	Advanced
Content Domain	Earth Science
Cognitive Domain	Applying

Disadvantage to farming by a river

The picture below shows a river flowing across a plain.



Farming is carried out on the plain and near the river.

There are advantages and disadvantages to farming along a river.

B. Describe one **disadvantage**.

It runs right by
dirty

S041201B

¹Met guidelines for sample participation rates only after replacement schools were included.

²National Defined Population covers 90 to 95 percent of National Target Population (see appendix A).

³National Target Population does not include all of the International Target Population (see appendix A). not covered and no official statistics were available.

⁴Exclusion rates for Azerbaijan and Georgia are slightly underestimated as some conflict zones were not covered and no official statistics were available.

⁵Nearly satisfied guidelines for sample participation rates after replacement schools were included.

⁶The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 15 percent, though it is less than 25 percent.

⁷The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 25 percent.

⁸National Defined Population covers less than 90 percent, but at least 77 percent, of National Target Population (see appendix A).

NOTE: Education systems are sorted by 2011 average percent correct. The answer shown illustrates the type of student response that was given full credit.

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

Education system	Percent full credit
International Avg.	34
Korea, Rep. of	64
Czech Republic	60
Italy	55
Finland	55
Slovak Republic	55
Romania	53
Thailand	52
Chinese Taipei-CHN	52
Netherlands ¹	52
Slovenia	51
Singapore ²	49
Austria	47
Ireland	46
Germany	46
Hong Kong-CHN ²	45
Denmark ²	44
Poland	44
Portugal	44
Hungary	43
Northern Ireland-GBR ¹	43
England-GBR	43
Russian Federation	42
Belgium (Flemish)-BEL	39
New Zealand	38
Australia	36
United States ²	35
Lithuania ^{2,3}	34
Sweden	33
Turkey	32
Georgia ^{3,4}	29
Japan	26
Kazakhstan ²	25
Azerbaijan ^{2,4}	25
Norway ⁵	25
Spain	24
Serbia ²	24
Chile	23
Croatia ²	22
Iran, Islamic Rep. of	22
Malta	16
Bahrain	15
Armenia	15
United Arab Emirates	14
Qatar ²	13
Saudi Arabia	11
Oman	7
Tunisia ⁶	7
Morocco ⁷	6
Kuwait ^{3,6}	5
Yemen ⁷	1

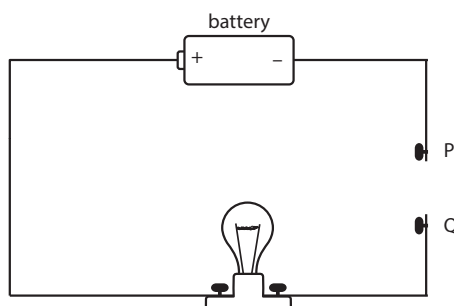
Benchmarking education systems	Percent full credit
Alberta-CAN ²	42
Ontario-CAN	36
Quebec-CAN	35
North Carolina-USA ^{2,3}	25
Florida-USA ^{3,8}	24
Dubai-UAE	21
Abu Dhabi-UAE	9

Exhibit B-15. Example 8th-grade science item: 2011

International Benchmark Level	Low
Content Domain	Chemistry
Cognitive Domain	Applying

Which rod causes the bulb to light?

Rods made of different materials are connected between points P and Q in the circuit diagram shown below.



Which rod would cause the bulb to light?

- ☒ A. copper rod
- ☐ B. wood rod
- ☐ C. glass rod
- ☐ D. plastic rod

Education system	Percent full credit
International Avg.	88
Russian Federation ¹	97
Hong Kong-CHN	96
Lithuania ²	96
Singapore ¹	96
Israel ³	95
Slovenia	95
England-GBR ⁴	95
Finland	94
Chinese Taipei-CHN	94
Japan	94
Chile	94
Thailand	93
Sweden	93
Indonesia	92
New Zealand	92
Turkey	92
Iran, Islamic Rep. of	91
Italy	91
Morocco	91
United States¹	90
Australia	89
Tunisia	88
Korea, Rep. of	88
Jordan	88
Palestinian Nat'l Auth.	87
Norway	87
Romania	87
Syrian Arab Republic	87
Hungary	87
Ukraine	86
United Arab Emirates	84
Malaysia	84
Bahrain	83
Macedonia, Rep. of	83
Qatar	80
Saudi Arabia	80
Kazakhstan	80
Georgia ^{2,5}	80
Armenia	79
Lebanon	78
Oman	73
Ghana ⁶	69

Benchmarking education systems	Percent full credit
Alberta-CAN ¹	95
Indiana-USA ^{1,2}	95
Minnesota-USA ²	93
Massachusetts-USA ^{1,2}	93
North Carolina-USA ^{2,3}	93
Connecticut-USA ^{1,2}	92
Florida-USA ^{1,2}	90
Ontario-CAN ¹	90
Quebec-CAN	90
Colorado-USA ²	90
Dubai-UAE	90
Alabama-USA ²	87
California-USA ^{1,2}	85
Abu Dhabi-UAE	83

¹National Defined Population covers 90 to 95 percent of National Target Population (see appendix A).

²National Target Population does not include all of the International Target Population (see appendix A).

³National Defined Population covers less than 90 percent, but at least 77 percent, of National Target Population (see appendix A).

⁴Nearly satisfied guidelines for sample participation rates after replacement schools were included.

⁵Exclusion rates for Georgia are slightly underestimated as some conflict zones were not covered and no official statistics were available.

⁶The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 15 percent, though it is less than 25 percent.

NOTE: Education systems are sorted by 2011 average percent correct. The answer shown illustrates the type of student response that was given full credit.

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

Exhibit B-16. Example 8th-grade science item: 2011

International Benchmark Level	Intermediate
Content Domain	Biology
Cognitive Domain	Knowing

Cells that destroy bacteria

Bacteria that enter the body are destroyed by which type of cells?

- ☒ A. white blood cells
- ☐ B. red blood cells
- ☐ C. kidney cells
- ☐ D. lung cells

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Education system	Percent full credit
International Avg.	61
Chinese Taipei-CHN	86
Singapore ¹	84
Korea, Rep. of	80
Italy	78
Japan	77
United States ¹	76
Sweden	74
Thailand	73
England-GBR ²	71
Iran, Islamic Rep. of	71
Australia	70
Israel ³	70
Lithuania ⁴	68
Lebanon	68
Tunisia	68
Finland	68
Saudi Arabia	67
Kazakhstan	67
Hong Kong-CHN	66
Indonesia	66
Hungary	64
New Zealand	62
Romania	60
Macedonia, Rep. of	60
Syrian Arab Republic	60
Russian Federation ¹	59
Qatar	59
Bahrain	58
United Arab Emirates	57
Armenia	55
Malaysia	54
Norway	54
Palestinian Nat'l Auth.	52
Chile	48
Jordan	48
Oman	43
Ukraine	42
Ghana ⁵	40
Turkey	37
Georgia ^{4,6}	35
Morocco	31
Slovenia	30

Benchmarking education systems	Percent full credit
Indiana-USA ^{1,4}	85
Minnesota-USA ⁴	84
Massachusetts-USA ^{1,4}	79
Connecticut-USA ^{1,4}	79
North Carolina-USA ^{3,4}	79
Florida-USA ^{1,4}	78
Alberta-CAN ¹	77
Ontario-CAN ¹	77
Colorado-USA ⁴	76
Alabama-USA ⁴	74
Dubai-UAE	70
California-USA ^{1,4}	69
Quebec-CAN	60
Abu Dhabi-UAE	56

¹National Defined Population covers 90 to 95 percent of National Target Population (see appendix A).

²Nearly satisfied guidelines for sample participation rates after replacement schools were included.

³National Defined Population covers less than 90 percent, but at least 77 percent, of National Target Population (see appendix A).

⁴National Target Population does not include all of the International Target Population (see appendix A).

⁵The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 15 percent, though it is less than 25 percent.

⁶Exclusion rates for Georgia are slightly underestimated as some conflict zones were not covered and no official statistics were available.

NOTE: Education systems are sorted by 2011 average percent correct. The answer shown illustrates the type of student response that was given full credit.

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

Exhibit B-17. Example 8th-grade science item: 2011

International Benchmark Level	High
Content Domain	Earth Science
Cognitive Domain	Knowing

Volcanic eruption effects

State one way that a volcanic eruption can affect the environment.

The hot magma can melt any thing away.

Education system	Percent full credit
International Avg.	48
Singapore ¹	81
Slovenia	78
Sweden	76
Finland	71
New Zealand	70
Lithuania ²	70
England-GBR ³	67
Russian Federation ¹	63
Japan	63
Australia	63
United States ¹	62
Chile	62
Korea, Rep. of	58
Kazakhstan	58
Romania	57
Chinese Taipei-CHN	55
Hong Kong-CHN	54
Hungary	54
Norway	49
Turkey	49
Israel ⁴	49
Ukraine	49
Thailand	47
Indonesia	45
Saudi Arabia	45
United Arab Emirates	42
Italy	41
Iran, Islamic Rep. of	37
Georgia ^{2,5}	34
Armenia	32
Bahrain	32
Jordan	32
Qatar	32
Malaysia	32
Macedonia, Rep. of	31
Palestinian Nat'l Auth.	31
Lebanon	28
Tunisia	28
Syrian Arab Republic	27
Oman	26
Morocco	19
Ghana ⁶	9

Benchmarking education systems	Percent full credit
Massachusetts-USA ^{1,2}	70
Ontario-CAN ¹	67
Colorado-USA ²	67
Connecticut-USA ^{1,2}	65
Minnesota-USA ²	65
Florida-USA ^{1,2}	64
Alberta-CAN ¹	61
Indiana-USA ^{1,2}	59
California-USA ^{1,2}	58
North Carolina-USA ^{2,4}	57
Quebec-CAN	56
Dubai-UAE	51
Alabama-USA ²	46
Abu Dhabi-UAE	39

¹National Defined Population covers 90 to 95 percent of National Target Population (see appendix A).

²National Target Population does not include all of the International Target Population (see appendix A).

³Nearly satisfied guidelines for sample participation rates after replacement schools were included.

⁴National Defined Population covers less than 90 percent, but at least 77 percent, of National Target Population (see appendix A).

⁵Exclusion rates for Georgia are slightly underestimated as some conflict zones were not covered and no official statistics were available.

⁶The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 15 percent, though it is less than 25 percent.

NOTE: Education systems are sorted by 2011 average percent correct. The answer shown illustrates the type of student response that was given full credit.

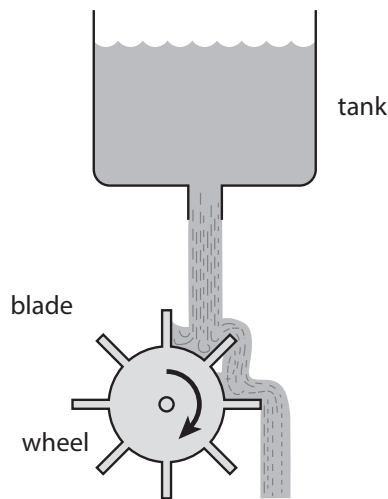
SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

Exhibit B-18. Example 8th-grade science item: 2011

International Benchmark Level	Advanced
Content Domain	Physics
Cognitive Domain	Reasoning

Water wheel: Faster rotation

The diagram shows water flowing from a tank and rotating a wheel.



C. Write one change to the system that will make the wheel rotate faster.

more water coming out at once; a bigger opening

S052165C

¹National Defined Population covers 90 to 95 percent of National Target Population (see appendix A).

²National Defined Population covers less than 90 percent, but at least 77 percent, of National Target Population (see appendix A).

³Nearly satisfied guidelines for sample participation rates after replacement schools were included.

⁴National Target Population does not include all of the International Target Population (see appendix A).

⁵Exclusion rates for Georgia are slightly underestimated as some conflict zones were not covered and no official statistics were available.

⁶The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 15 percent, though it is less than 25 percent.

NOTE: Education systems are sorted by 2011 average percent correct. The answer shown illustrates the type of student response that was given full credit.

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

Education system	Percent full credit
International average	27
Singapore ¹	67
Japan	58
Hong Kong-CHN	46
Korea, Rep. of	44
Israel ²	44
Chinese Taipei-CHN	44
England-GBR ³	42
Finland	41
Iran, Islamic Rep. of	40
Turkey	37
Russian Federation ¹	37
Australia	36
Slovenia	35
Hungary	34
Norway	31
Ukraine	31
Lithuania ⁴	31
New Zealand	29
United States¹	28
Sweden	26
Syrian Arab Republic	25
Romania	25
Italy	23
Oman	23
Kazakhstan	20
Tunisia	20
Palestinian Nat'l Auth.	20
Bahrain	18
Jordan	18
United Arab Emirates	18
Saudi Arabia	17
Macedonia, Rep. of	17
Qatar	17
Malaysia	16
Armenia	16
Georgia ^{4,5}	13
Chile	12
Lebanon	11
Thailand	10
Indonesia	9
Morocco	5
Ghana ⁶	3

Benchmarking education systems	Percent full credit
Massachusetts-USA ^{1,4}	37
Minnesota-USA ⁴	35
Alberta-CAN ¹	35
Colorado-USA ⁴	33
Connecticut-USA ^{1,4}	33
Ontario-CAN ¹	32
Quebec-CAN	31
Indiana-USA ^{1,4}	25
Florida-USA ^{1,4}	25
Dubai-UAE	24
North Carolina-USA ^{2,4}	23
Alabama-USA ⁴	17
California-USA ^{1,4}	17
Abu Dhabi-UAE	17